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PALEOCENE PRIMATES FROM THE SHOTGUN MEMBER OF THE FORT UNION FORMATION IN THE WIND RIVER BASIN, WYOMING

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During the summer of 1959, while carrying on a geologic study of the Shotgun Butte area in the western part of the Wind River Basin in Wyoming, W. R. Keefer of the U.S. Geological Survey discovered a fossiliferous horizon in the Fort Union formation remarkably rich in the remains of vertebrate animals, particularly mammalian teeth. A sample collection was sent to me for study and report, and my tentative list of the Mammalia encountered was included in his report of 1961 (see also Keefer and Troyer, 1964). The original locality is in the SE¼ of sec. 30, T. 6 N., R. 3 E. (Keefer, 1965, p. A10), about 220 feet above the base of the upper part of the Fort Union formation which Keefer (1961) named the Shotgun member.

Collections by parties from the Smithsonian Institution in 1961 and 1964 were made at the original locality, where the steeply south dipping bed was found to extend from near the Cottonwood Creek road in the south-central part of Section 30 eastward to the northwest slope of a prominent butte in the SE¼ of section 30. Collecting by parties from the University of Wyoming and the Museum of Comparative Zoology have included localities described (Patterson and McGrew, 1962) as in the NE¼, SE½[1], sec. 31. A collection made by McKenna

[1] This has since been corrected by MacIntyre (1966) to read SE¼.

in 1965 for the American Museum is not recorded as to precise locality, but only as coming from low in the Shotgun member. More recently Craig Wood of the Museum of Comparative Zoology has devoted considerable time to a study of this occurrence and has made collections from various localities in the Shotgun member as exposed in Cottonwood Creek-Twin Buttes area, but evidently most of the materials he has obtained are essentially from about the same faunal unit although there is a stratigraphic difference of about 90 feet between his upper and lower levels within the lower part of the member.

At the time of my original listing of the Mammalia represented in Keefer's 1959 collection, David H. Dunkle reported (also in Keefer, 1961) on the fossil fish remains in this collection and I briefly discussed the occurrence and its age in the Wyoming Geological Association Guidebook for 1961. In 1962 Patterson and McGrew in joint papers described arctocyonid creodont and picrodontid insectivore(?) remains from the Shotgun faunal horizon. Subsequently McGrew (1963) discussed the environmental significance of the shark teeth found in the collections and MacIntyre included Shotgun materials in his study of Paleocene miacid carnivores. The present study of the primates was undertaken in a cooperative arrangement with Craig Wood, who in 1967 expressed to me an interest in studying the occurrence as a doctoral thesis at Harvard University. The present study completes my contribution to the faunal investigation.

The age of the Shotgun fauna,[2] as represented in the abundantly fossiliferous zone low in the Shotgun member, appears rather clearly to be upper or late Torrejonian, about intermediate between the essentially middle Torrejonian fauna represented in the Gidley Quarry or the No. 2 level of the Lebo in Montana and the early Tiffanian represented at the lowest or saddle locality in the Bison Basin of Wyoming. This age assignment was made tentatively in 1961, although certain features of the association led me at that time to conclude that further study might demonstrate an early Tiffanian age.

[2] Not to be confused with the fauna known from near the top of the member as exposed on Shotgun Butte proper, which I have found to include *Plesiadapis*, cf. *cookei*, *Phenacodus primaevus*, and *Ectocion ralstonensis*, and to represent a late Paleocene or early Eocene age.

Further review of the materials, however, particularly the primates, rather strikingly demonstrates the intermediate character of the greater part of the fauna.

The primates occurring in the Shotgun fauna may be listed as follows:

PLESIADAPIDAE

Pronothodectes intermedius, n. sp.
Plesiadapis, sp.

PAROMOMYIDAE

Palenochtha, cf. *minor* (Gidley)
Palaechthon woodi, n. sp.
Palaechthon, near *P. alticuspis* Gidley
Plesiolestes, cf. *problematicus* Jepsen
Cf. *Torrejonia wilsoni* Gazin
Paromomys, near *P. depressidens* Gidley
Phenacolemur fremontensis, n. sp.
Phenacolemur, cf. *frugivorus* Matthew and Granger

CARPOLESTIDAE

Elphidotarsius shotgunensis, n. sp.
Carpodaptes, sp.

The relative stage represented by the foregoing primate assemblage is perhaps best shown by the intermediate character of the rather abundant materials of *Pronothodectes intermedius* which tends to bridge the gap between *P. gidleyi* of the Lebo and *P. simpsoni* of Bison Basin. The presence of such genera as *Palenochtha*, *Palaechthon*, *Plesiolestes*, *Torrejonia*, *Paromomys*, and *Elphidotarsius* argue strongly for a Torrejonian assignment, noting, however, that certain of these are distinctly more progressive than their Lebo counterpart. On the other hand, *Plesiadapis*, *Phenacolemur*, and *Carpodaptes* are more suggestive of a Tiffanian stage, although one of these, *Phenacolemur fremontensis*, is clearly less progressive than the Melville and Tiffany forms. Certain materials, such as those of *Plesiadapis* sp., *Phenacolemur*, cf. *frugivorus*, and *Carpodaptes* sp., seem advanced over those of closely related forms in the fauna and might suggest a mixture of materials from different levels. A review of the occurrences of each of

these forms, although but sparsely represented in any case, show an association in certain restricted localities with one or more forms that are regarded as structurally more indicative of the intermediate position in time. *Plesiadapis* sp., has been found associated with most of the forms, particularly *Pronothodectes intermedius* at the original locality in section 30. *Phenacolemur*, cf. *frugivorus* occurs in an M.C.Z. field locality designated as "Williams extension" associated with *Pronothodectes*, *Palaechthon*, *Torrejonia*, and *Paromomys*. *Carpodaptes* sp., on the other hand, has been found only on certain anthills, but at one of these ("Anthill #1") where it occurs with fairly large teeth of *Plesiadapis* sp., there were also found an upper molar regarded as representing *Phenacolemur fremontensis* and two lower molars of *Pronothodectes intermedius*. Certain of Wood's anthill localities, however, invariably include material of the more advanced forms, suggesting a slightly later stage with possibly relict representation of apparently earlier types, unless, of course, association is due to an admixture of materials through stream washing or reworking during sedimentation.

Acknowledgment is made of the courtesy extended by Dr. Paul O. McGrew of the University of Wyoming, Dr. Malcolm C. McKenna of the American Museum of Natural History, and particularly of Mr. Craig B. Wood of the Museum of Comparative Zoology, in turning over to me for this study the primate materials in their respective collections from the Shotgun Butte area. The pencil-shaded drawings of the specimens, the histogram and other graphic displays included in this report were prepared by Mr. Lawrence B. Isham, staff illustrator for the Department of Paleobiology in the National Museum of Natural History.

Plesiadapidae

Pronothodectes intermedius n. sp.

(Figs. 1–3)

Type: Left ramus of mandible with P_4–M_3, U. of Wyo. No. 3223.

Horizon and locality: Shotgun member of Fort Union formation, near Cottonwood Creek, sec. 30–31, T. 6 N., R. 3 E., northwestern part of Wind River Basin, Wyoming.

Specific characters: Intermediate in size between *Pronothodectes matthewi* Gidley (1923) and *Pronothodectes simpsoni* Gazin (1956). Talonid

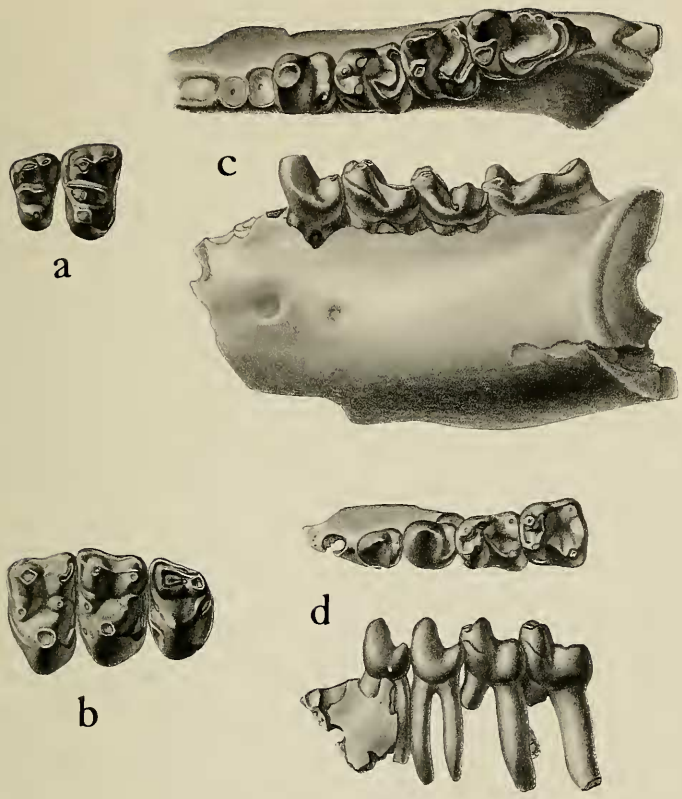


Fig. 1. *Pronothodectes intermedius*, n. sp. a, Lt. P^3 and P^4, M.C.Z. no. 18742, occlusal view. b, Lt. M^1–M^3, A.M.N.H. no. 88308, occlusal view. c, Lt. ramus of mandible with P_4–M_3, U.W. no. 3223 (type), occlusal and lateral views. d, Lt. P_3–M_2 with jaw fragment, U.S.N.M. no. 26339, occlusal and lateral views. All figures ×4.

crest on P_4 slightly broader than in *P. matthewi*. Lower molars relatively broad.

Discussion: In the collections available to me there are ten lower jaw fragments with two or more teeth; two of these have three teeth and two others have four teeth each. However, only two maxillary fragments, one exhibiting P^3 and P^4 (see Fig. 1a), and the other M^1–M^3 (see Fig. 1b), include more than one tooth. Nevertheless, approximately 270 isolated cheek teeth are recognized as representing *P. intermedius*, of which 125 are uppers.

In addition to the maxillary fragment with P^3 and P^4, there are about

22 isolated upper premolars almost evenly divided between third and fourth. P^3 and P^4 are rather alike except that P^3 is a little smaller and more nearly triangular in outline. Both exhibit the prominent conule presumed to be the protoconule. The metacone (or tritocone) is distinct and rather close to the paracone on P^4 but on P^3 it is usually weaker and sometimes imperceptible. The protocone (or deuterocone) is a strongly developed, essentially circular cone on P^4 with a somewhat longer posterior slope. This cusp, though prominent, is relatively smaller on the more constricted talon of P^3. The external cingulum is only weakly developed on P^4 and usually but scarcely evident on P^3. The outer margin of these teeth in occlusal view is gently convex, but occasionally indented on P^4, with rounded anterior and posterior angles. A small parastyle is evident on P^4 at the antero-external angle, and lingual to this the anterior cingulum extends to the base of the protocone and descends to the apex of this cusp as a very weak crest on its antero-external surface. It may also send a branch anterior to the base of the protocone. A posterior cingulum, somewhat concave in occlusal view, extends from the base of the weak posterior crest of the metacone to a position posterolingual to the protocone then descends as a weak crest to the apex of this cusp. The cingula on P^3 are more weakly developed and apparently do not extend down toward the apex of the protocone. A small parastyle may be seen on some P^3's, but not invariably.

In a comparison with smaller *Pronothodectes matthewi* it is seen that certain isolated P^4's of *P. intermedius* come very close in cusp development and arrangement. I note, however, in the type of *P. matthewi*, which is the only specimen at hand with P^4 preserved, the antero-external angle is more acute, although the parastyle is less distinctly developed as a cuspule than is usual in *P. intermedius*. It should be noted, however, that teeth in this type are somewhat worn. P^3 is not included in the material of *P. matthewi* at hand, and no upper premolars of *P. simpsoni* have been seen.

The anterior upper molars of *Pronothodectes intermedius* are nearly quadrate in outline but with the lingual margin more convex and somewhat oblique. M^1 and M^2 are much alike except that M^1 is smaller and relatively shorter transversely and often a little narrower lingually. The paracone and metacone in both are about equal in size, well spaced, and with a subdued anteroposterior crest joining them and extending from these cusps to the cingulum fore and aft. The protocone is noticeably larger than the outer cusps. It is essentially a rounded cone with low but distinct external crests to the small conules and a posterior crest to the cingulum. The conules are sharply set off from the external cusps but a crest extends from the protoconule to the antero-external angle of the tooth. The prominent external cingulum is slightly bilobed to nearly straight, extending around the moderately blunt antero-external and postero-external angles, where it descends slightly to meet the crests from the paracone and metacone respectively. There is no mesostyle but a few teeth show a very weak median cuspule on the external cingulum.

The anterior cingulum extends inward prominently to join the protoconule. A part of the anterior cingulum which terminates lingually anterior to the protocone may join the crest from the protoconule but is often discontinuous at this point. The posterior cingulum extends lingually from the posterior crest of the metacone, becoming decidedly shelflike as it approaches the posterior slope of the protocone where it turns abruptly and descends more subdued to the apex of this cusp. A cingular crest is not developed lingual to the protocone.

M^3 is smaller than M^2 and the outer wall is more oblique with the postero-external angle decidedly obtuse. The external and posterior cingular margins are generally more convex and the anterior margin may be a little more convex than in the anterior molars. The metacone is well spaced from the paracone but noticeably smaller. The protocone is well developed, but the conules, particularly the metaconule, appear more subdued.

The upper molars of *Pronothodectes intermedius* are much like those in the type of *P. matthewi*, except for a slightly more inflated appearance of the cusps and the crests are a little better defined, although as noted above, the teeth in this type show some evidence of wear, as they do in the figured upper molars of *P. intermedius*. In M^1 it is noted that the lingual portion is generally not so narrow relatively and the postero-external angle is usually not so acute as in *P. matthewi*, although the specimen here figured is more like *P. matthewi* in this respect. A single first upper molar in the Bison Basin collection, believed to represent *P. simpsoni*, is seen to be more rounded and relatively a little longer antero-posteriorly. It also shows relatively weaker crests and conules than is usual in the smaller M^1's of *P. intermedius*.

Among the lower jaw fragments only two are sufficiently preserved anteriorly to give indication of the number of teeth represented. The type of *P. intermedius* (Fig. 1c) and a referred specimen (USNM No. 26339, see Fig. 1d) show a strong single root for P_2 and a somewhat smaller alveolus immediately antero-external to P_2, extending downward and outward postero-external to the enlarged incisor. It has a position much as in *P. simpsoni* but noticeably less procumbent. It may well be for the canine (probably not P_1 as suggested by me in 1956). An alveolus in about this position with respect to the large incisor in a specimen of *P. matthewi* (USNM No. 9332) is just ahead of the small canine and thought by Simpson (1937) to be for a vestigial lateral incisor. Other jaws of *P. matthewi* in the U.S. National Museum collections apparently show no indication of this vestige, so that the formula for the lower dentition, except for an occasional vestige of a probable lateral incisor in *P. matthewi*, is essentially the same in all three species.

Although undoubtedly represented, the probable canine and P_2 have not been recognized among the isolated teeth in the collections. About 21 isolated posterior lower premolars have been identified and in one specimen (USNM No. 26339) P_3 and P_4 are associated. In only this specimen and in the type is P_4 found associated with the molars. P_3 and

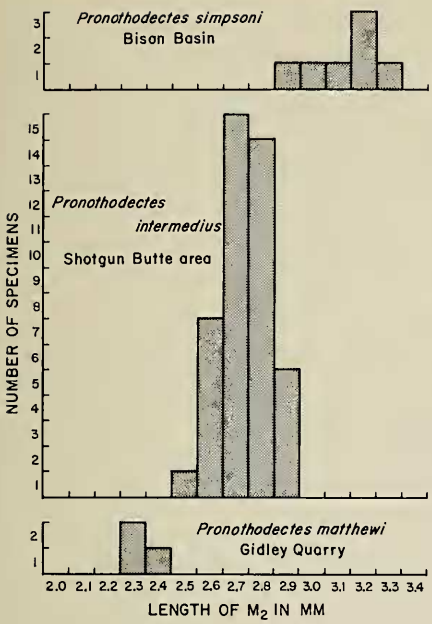
P_4 are very much alike but differ in size and there is a somewhat more inflated appearance to the primary cusp in P_4. There is no evidence of a parastylid or metaconid on either. The length of the talonid appears variable but is generally rather short and exhibits a transverse crest posteriorly which is relatively narrower in P_3. This crest may be smooth and somewhat convex upward or incipiently bicuspid.

P_4 in *P. intermedius*, in addition to its greater size, exhibits a more inflated primary cusp than in *P. matthewi* and the posterior crest of the talonid is not so constricted transversely. P_4 in still larger *P. simpsoni*, though somewhat variable in proportions, appears relatively more elongate than in *P. intermedius* and the talonid may be more distinctly bicuspid. P_3 is not represented in the Gidley Quarry material of *P. matthewi* at hand, and in only a badly worn specimen of *P. simpsoni*.

The lower molars are well represented in *P. intermedius* and there are well over a hundred isolated teeth in addition to the ten lower jaw portions. M_1 is a little shorter than M_2 and both M_1 and M_3 are narrower. M_1 tapers forward somewhat, whereas in M_2 the trigonid and talonid portions are more nearly the same width. The elongate talonid of M_3 may be slightly narrower than the trigonid but in some instances it is broader across the hypoconid and entoconid. The hypoconulid portion of M_3 is generally broad. The outer walls of the trigonids are decidedly sloping, most noticeably in M_1, where the apex of the trigonid is transversely more constricted with the protoconid closer to the somewhat better separated paraconid and metaconid than in M_2. The crista obliqua generally shows a notch or crease immediately anterior to the hypoconid and this crest generally terminates abruptly against the wall of the trigonid posterior to the protoconid, but in M_1 it tends to rise obliquely toward the metaconid. The entoconid in M_1 and M_2 at the postero-internal angle of the tooth is elevated, but a little less so than the hypoconid. The crest between these cusps is somewhat depressed and there is no hypoconulid. The crest forward from the entoconid slopes downward and joins the postero-lingual margin of the trigonid at a sharp angle enclosing a talonid basin that appears relatively short and broad in M_1 and M_2. In M_3 the talonid is decidedly elongate and has a broad crestlike hypoconulid as well as a prominent hypoconid, but the entoconid is often poorly defined or has lost its identity on the lingual crest.

The anterior lower molars are much alike in the three species, although in certain specimens of *P. intermedius*, particularly the type, they appear relatively a little broader than in the other two forms, contributing to the somewhat shorter and broader appearance of the talonid basin. The hypoconulid portion of M_3 is rather variable, but appears generally to be a little less constricted than in *P. simpsoni*, but not invariably so. I note further that, as in *P. matthewi*, the cingulum antero-external to the protoconid in all of the molars tends in general to be a little better defined than in *P. simpsoni*.

Graphs have been prepared showing a comparison between *P. intermedius*, earlier *P. matthewi*, and later *P. simpsoni* in the length of M_2.



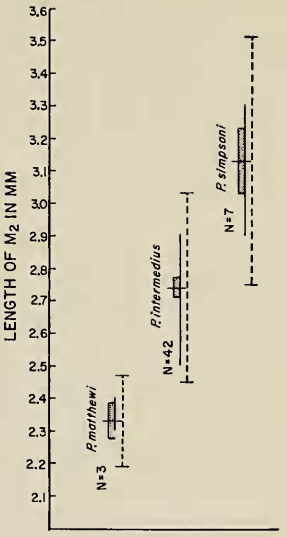


FIG. 2 (left). Histogram of length of M_2 in species of *Pronothodectes* from three horizons of the Paleocene; middle Torrejonian (below), late Torrejonian (middle), and early Tiffanian (above).

FIG. 3 (right). Graphic display of differences in mean, observed range, and theoretical range of the length of M_2 in three forms of *Pronothodectes* from the Paleocene; *P. matthewi* (lower left) from the middle Torrejonian Gidley Quarry, *P. intermedius* (middle) from the later Torrejonian in the Shotgun Butte area, and *P. simpsoni* (upper right) from the early Tiffanian at Bison Basin. The solid vertical line represents the observed range in the length of M_2. The rectangle represents the range of $(M - 2\sigma_m)$ to $(M + 2\sigma_m)$ with the mean marked as a crossbar. The dashed line represents the theoretical range $(M \pm 3\sigma)$. (See Simpson and Roe, 1939, p. 318.)

One of these (Fig. 2) is a display of frequency distributions and shows the intermediate character of this variable in *P. intermedius*. The other (Fig. 3) is a graphic representation of the observed and theoretical ranges in the length of M_2 as well as a comparison of the means, which have been expanded by twice the standard error of the mean above and below its arithmatic value (see Simpson and Roe, 1939, p. 318). In one form, *P. matthewi*, the number of specimens involved for mathematical treatment is clearly inadequate, but from other considerations the separa-

tion of *P. intermedius* from *P. matthewi* might seem a little better defined than perhaps its separation from *P. simpsoni.* Nevertheless, in a time sequence of variants, such as involved here, recognition of an intermediate form is by nature arbitrary, but there would here appear to be a reasonable basis, and definition of a separate entity has practical value in discussions of faunal relationships and comparative ages.

Measurements (in mm) of teeth in specimens of *Pronothodectes intermedius.*

	M.C.Z. No. 18742	A.M.N.H. No. 88308
Length of upper molar series	—	6.7
P^3, anteroposterior diameter externally	2.0	—
P^3, transverse diameter perpendicular to outer wall	2.4	—
P^4, anteroposterior diameter externally	2.2	—
P^4, transverse diameter perpendicular to outer wall	3.4	—
M^1, anteroposterior diameter externally	—	2.3
M^1, transverse diameter perpendicular to outer wall	—	3.5
M^2, anteroposterior diameter externally	—	2.4
M^2, transverse diameter perpendicular to outer wall	—	3.7
M^3, anteroposterior diameter through midsection	—	2.1
M^3, greatest transverse diameter	—	3.2

	U. of Wyo. No. 3223 (type)	U.S.N.M. No. 26339	M.C.Z. No. 18741
Length of lower molar series	8.5	—	8.6
P_3, anteroposterior diameter	—	1.7	—
P_3, transverse diameter	—	1.4	—
P_4, anteroposterior diameter	2.1	2.0	—
P_4, transverse diameter	2.0	1.8	—
M_1, anteroposterior diameter	2.4	2.4	2.6
M_1, greatest transverse diameter	2.4	2.2	2.2
M_2, anteroposterior diameter	2.6	2.6	2.7
M_2, greatest transverse diameter	2.5	2.5	2.5
M_3, anteroposterior diameter	3.6	—	3.7
M_3, greatest transverse diameter	2.2	—	2.3

Plesiadapis sp.

Five plesiadapid lower molars, three anterior upper molars, and a premolar are too large to be included with the material of *Pronothodectes intermedius.* Moreover, the relatively greater width of the lower molars, particularly across the talonid portion is quite unlike *Pronothodectes* and

strongly suggests *Plesiadapis*. In size they closely approach the Tiffanian forms *Plesiadapis anceps* Simpson (1936) and *Plesiadapis jepseni* Gazin (1956) and the lowers resemble both in the marked outer slope of the trigonid. A third lower molar exhibiting a rather broad talonid suggests *P. jepseni* or *P. gridleyi* rather than *P. anceps*. Also, the upper premolar here included, unlike *P. anceps*, has a well developed conule. The presence or absence of a P_2 cannot, of course, be determined.

Distinct from the foregoing there is a third lower molar from an anthill locality that is quite as large as would be expected in *Plesiadapis rex* (Gidley, 1923).

PAROMOMYIDAE

Palenochtha, cf. *minor* (Gidley)

An exceedingly small primate is represented by five lower teeth, three M_1's and two M_2's. In size they are slightly but not significantly larger than in the type of *Palenochtha minor* (Gidley, 1923) which they strongly resemble. The first molars are almost identical to those of *P. minor* although I note a slightly better defined entoconid in the Shotgun material. In the second molars, believed to represent the same form, the cusps of the trigonid are a little less well defined with the paraconid and metaconid a little closer together.

These teeth also compare well in size with those in the type of *Navajovius kohlhaasae* Matthew and Granger (1921), being only slightly smaller for the most part. A rather distinctive difference, however, is noted in the trigonid of the first molars which, as in *P. minor*, have a much more oblique posterior wall. Also, as noted in the material of *Palaechthon* as well as in *Palenochtha*, the talonid basin does not appear so elongate, with the crista obliqua more oblique, not so forward directed as in *Navajovius*.

So far no upper molars in the collections have been recognized as belonging to this form, although upper molars of *Palenochtha minor* from the Gidley Quarry are rather distinctive.

Palaechthon woodi[3] n. sp.

(Fig. 4a)

Type: Portion of left ramus of mandible with P_4–M_2 (MCZ No. 18740)

Horizon and locality: Shotgun member of Fort Union formation, near Cottonwood Creek, section 30 or 31, T. 6 N., R. 3 E., northwestern part of Wind River Basin, Wyoming.

Specific characters: Size of teeth distinctly smaller than in *Palaechthon alticuspis* Gidley (1923). P_4 with parastylid and metaconid a little less well defined. Primary cusp of P_4 and trigonids of molars relatively a little less elevated.

Discussion: In addition to the type lower jaw (Fig. 4a) there are

[3] Named for Craig Wood who found the type specimen.

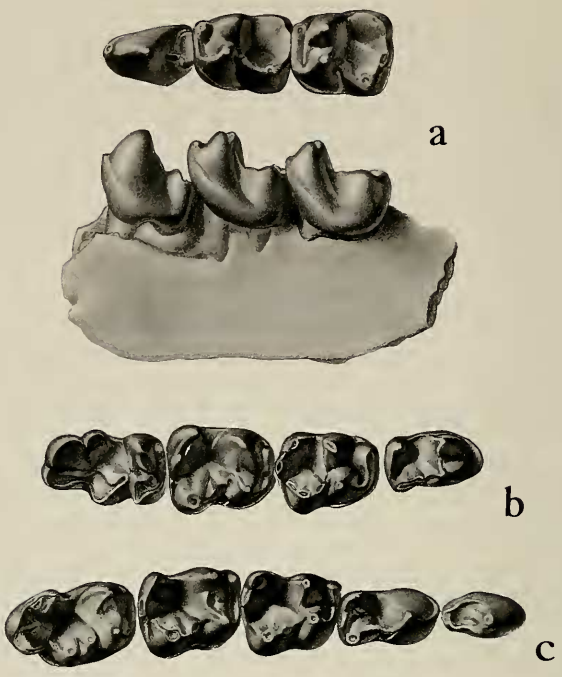


Fig. 4. a, *Palaechthon woodi*, n. sp., Lt. ramus of mandible with P_4–M_2, M.C.Z. no. 18740 (type), occlusal and lateral views, ×8. b, *Plesiolestes*, cf. *problematicus* Jepsen, composite right lower cheek-tooth series: P_4, M.C.Z. no. 18770; M_1, M.C.Z. no. 18771; M_2, M.C.Z. no. 18772; and M_3, A.M.N.H. no. 88313; occlusal view, ×6. c, Cf. *Torrejonia wilsoni* Gazin, composite right lower cheek-tooth series: P_3, M.C.Z. no. 18759 (reversed); P_4, M.C.Z. no. 18760; M_1, M.C.Z. no. 18761; M_2, M.C.Z. no. 18762; M_3, U.W. no. 3251; occlusal view, ×4.

about 13 isolated teeth that appear to represent this form, nine of which are lowers. The teeth are about midway in size between those of *Palaechthon alticuspis* from the Gidley Quarry and much smaller *Navajovius kohlhaasae* Matthew and Granger (1921) from the later Tiffany beds.

Among the four upper teeth believed to represent *Palaechthon woodi* there is a P^4, not represented in the *Palaechthon alticuspis* material at hand, which resembles this tooth in *Navajovius kohlhaasae*. In addition to its greater size it shows a relatively greater transverse width, with the conical deuterocone a little more lingual in position. The cuspate parastyle projects well forward as in *N. kohlhaasae*, and the postero-external angle and the posterior crest from the primary cusp are similarly

developed, except that there is indication of a weak tritocone in *N. kohlhaasae* not seen in the tooth referred to *P. woodi.*

Two anterior upper molars, possibly M^1 and M^2, are comparatively small, a little nearer *N. kohlhaasae* in size, but are relatively much wider transversely, as they are in *P. alticuspis.* The outer cusps with the strong postero-external crest from the metacone and configuration of the outer cingulum are very much as in *P. alticuspis.* The outer cingulum on these teeth in *N. kohlhaasae* is noticeably more reduced. The elongate talon of these molars exhibits a large forward placed protocone and a strong posterior cingulum which at its lingual extremity is deflected toward the protocone much as in *P. alticuspis* but does not show the more cuspate development of a hypocone on the relatively weaker posterior cingulum seen in *Navajovius.* It may be noted that in *Palenochtha minor* the elongate talons of the upper molars are rather sinuous in outline. The conules in the *P. woodi* (?) teeth are clearly defined at the outer extremities of the low crests from the protocone. They are triangular in outline and sharply separated from the adjacent outer cusps.

A third upper molar that may belong to *P. woodi* is a little large relative to the anterior molars discussed above but is smaller than in the one specimen of *P. alticuspis* that has this tooth preserved. It has the elongate talon with the strong posterior cingulum exhibited in *P. alticuspis.* The external cingulum, however, is more convex about the paracone and small metacone, and there is less development of the parastyle. In *Navajovius* this tooth with its narrower talon is decidedly more triangular in outline and the cingula are less developed.

Among the isolated lower teeth of *P. woodi* there are two P_4's tentatively assigned, in addition to this tooth in the type lower jaw. P_4 has much the same form as that in *P. alticuspis,* although the primary cusp appears to be relatively a little less elevated than in the type of the latter. It should be noted, however, that there is some variation in the height of this cusp in referred material of *P. alticuspis.* The parastylid and metaconid in P_4 of *P. woodi* are not so well developed as in *P. alticuspis* and are scarcely evident in one of the referred premolars of *P. woodi.* The talonid of P_4 is slightly damaged in the type of *P. woodi* but with the aid of the referred specimens it is seen that there is a high posterior crest, essentially bicuspid, which externally curves forward to join medially the posterior wall of the primary cusp, much as in *P. alticuspis.* In *Navajovius kohlhaasae* the primary cusp has a somewhat more inflated appearance with no cingulum developed, there is no parastylid, and only the slightest evidence of a metaconid. The talonid is relatively much narrower and the posterior crest less evidently cuspate, with the crest forward to the primary cusp joining its posterior wall somewhat more lingually.

The anterior lower molars, represented by six isolated teeth in addition to the type, are essentially similar to those in *P. alticuspis,* although, as noted for the primary cusp of P_4, the trigonid appears a little less elevated in a comparison of the types. Also the metaconid, as well developed as

the protoconid in *P. woodi*, appears a little less inflated than in *P. alticuspis*. The antero-external cingulum about the protoconid is much the same. The talonid portions, except for size, are nearly identical, with both showing a small cuspule or swelling on the crista obliqua. The much smaller anterior molars in *Navajovius kohlhaasae* are relatively longer and narrower. This is most noticeable in the talonid basin, and the crista obliqua is smoother and directed more forward, not so oblique as in *P. woodi*. Moreover, there is no development of a cingular crest about the protoconid of M_1, although this is slightly evident on M_2 in *N. kohlhaasae*.

A single isolated M_3, corresponding in size and in the character of the trigonid with anterior molars of *P. woodi*, is much as in referred material of *P. alticuspis* (the type lacks M_3) although again the trigonid appears a little less elevated than in USNM Nos. 9602 and 9486 from Gidley Quarry, and the protoconid as well as the metaconid is less inflated appearing. The talonid is rather similar although a little less constricted across the hypoconulid. In form the M_3 referred to *P. woodi* is not greatly different than that in *N. kohlhaasae*, but it should be noted that in *Palaechthon* M_3 is not nearly so reduced in size relative to M_2 as it is in *Navajovius*.

Measurements (in mm) of lower teeth in species of *Palaechthon*.

	P. woodi MCZ 18740 (type)	*P. alticuspis* USNM 9532 (type)
P_2, anteroposterior diameter		1.2
P_2, transverse diameter		0.8
P_3, anteroposterior diameter		1.2
P_3, transverse diameter		0.7
P_4, anteroposterior diameter	1.6	2.0
P_4, transverse diameter	1.1	1.2
M_1, anteroposterior diameter	1.8	2.1
M_1, greatest transverse diameter	1.3	1.5
M_2, anteroposterior diameter	1.9	2.2
M_2, greatest transverse diameter	1.4	1.6

Palaechthon, near *P. alticuspis* Gidley

Among the isolated teeth are three upper and four lower molars that appear referable to *Palaechthon* and are only slightly larger than *P. alticuspis*. Although there is a close resemblance to *P. alticuspis*, I note that the cusps in both upper and lower teeth are a little blunter. Also, the talon of the anterior upper molars seems broader and the anterior lower molars appear relatively a little wider. In detail the cusps of the trigonid in the lower molars are actually more like *P. woodi* but there is too great a discrepancy in size for this species to be represented.

Plesiolestes, cf. *problematicus* Jepsen
(Fig. 4b)

Approximately 45 isolated teeth are recognized as representing a form of *Plesiolestes*, probably not distinct from *Plesiolestes problematicus* Jepsen (1930). About three-fourths of these are lower teeth which show a range in size closely comparable to that in the Rock Bench material.

Particularly characteristic of *Plesiolestes* is the advanced molariform condition of P_4 (see Fig. 4b), in which the metaconid is large and the talonid has a well developed basin. The paraconid is prominent, though low and well forward, and is sharply deflected lingually from the steeply sloping anterior crest of the protoconid. The talonid in most instances has about the same width as the trigonid and exhibits a well defined hypoconid and entoconid at the posterior angles of the tooth. Where not obscured by wear the posterior crest between the hypoconid and entoconid may show a somewhat flattened hypoconulid, perhaps a little more sharply separated from the hypoconid than from the entoconid. The crista obliqua extending forward to a low point on the posterior wall of the protoconid may show evidence of an incipient cuspule. It is of further interest to note that among the ten P_4's seen, three (those in the American Museum collection from unrecorded localities in the area) show a weaker metaconid, more closely appressed to the protoconid. The larger of these (AMNH No. 88312), which is associated with a P_3, also exhibits a relatively wider talonid than the others. These may represent individual variation, but the possibility that a different species is represented among the materials is not certainly eliminated.

Among the isolated lower molars (see Fig. 4b) it is sometimes difficult to distinguish M_1's from M_2's, evidently because of the molariform condition of P_4. The anterior molars, it is noted, show a high trigonid with well developed cusps. An anterior transverse crest is developed from the anterior slope of the protoconid, terminating lingually in a prominent paraconid, which tends to be a little more forward and less lingual in M_1's. The metaconid is somewhat elongate antero-externally and this is nearly matched by an anterolingual ridge on the protoconid. These projections join about midway between the anterior crest and the posterior wall of the trigonid. The relatively broad talonid exhibits a well developed hypoconid and entoconid at the posterior angles, with their apices conical and raised above their respective crescents. The crista obliqua is generally notched and deeply folded on the lingual side, defining a sometimes prominent cuspule anterolingual to the hypoconid. The posterior crest of the talonid shows an anteroposteriorly flattened hypoconulid more sharply separated from the hypoconid than the entoconid, a little as in the mixodectids. A cingular shelf or ridge is developed around the base of the protoconid, extending around the front of the tooth. Occasionally it extends weakly around the hypoconid.

In M_3, four of which were seen, the trigonid portion is much as in the preceeding tooth and the talonid portion is characterized by well separated, essentially conical cusps, with that on the crista obliqua well

defined. The third lobe or hypoconulid portion of the tooth is distinctly bilobed and set off from the hypoconid portion by a rather deep external re-entrant. As in the anterior molars, the cingulum extends across the front, around the protoconid base, and may continue posteriorly around hypoconid.

Upper teeth of *Plesiolestes* have not been described, but assuming a close relationship between *Plesiolestes* and *Palaechthon*, as discussed by Simpson (1937b, p. 143), approximately a dozen Shotgun upper molars showing a resemblance to *Palaechthon alticuspis*, but of a size appropriate for *Plesiolestes problematicus*, have been tentatively included with this material. These show a similar transverse elongation but with somewhat higher cusps and conules. The external cingulum and the crest joining it from the metacone are perhaps a little more outstanding. Also, there is better evidence in certain of the molars for a definable hypocone.

Cf. *Torrejonia wilsoni* Gazin
(Fig. 4c)

About 14 lower teeth and possibly three upper molars represent a primate which appears very close to *Torrejonia wilsoni* Gazin (1968), although slightly larger in size. Originally described from the Torrejon middle Paleocene of New Mexico it has since been tentatively recognized in beds of about that age in the Evanston formation of southwestern Wyoming (Gazin, 1969).

The upper molars are rather questionably referred but show some resemblance to the isolated upper molar from the Torrejon thought to be of *Torrejonia*. They vary somewhat in size and in their relative transverse width, but show the elongate slender talon with less expansion of the postero-internal basin in comparison with *Paromomys maturus*, as does the Torrejon upper molar.

Among the lower teeth are three P_3's and one P_4. These have essentially the same form as in the type but with a slightly better developed talonid. In P_3 the anterior crest extends downward and inward much as in the Torrejon specimen but two of these show an almost imperceptible parastyle at the anterior flexure. In all three there is better development of a postero-internal cusp on the talonid, although it should be noted that the type is slightly damaged at this point. In P_4 (see Fig. 4c) the primary cusp is almost identical in form with that in the type but the posterior wall does not show the weak double flexure near its apex seen in the type. There is no evidence of a metaconid. The talonid has much the same form as in P_4 of the type but is relatively a little longer and broader with a stronger hypoconid and an almost imperceptible hypoconulid. The differences between *Torrejonia wilsoni* and *Paromomys maturus* in the character of P_4 are somewhat emphasized in the Shotgun Butte tooth.

The configuration of the lower molars (see Fig. 4c) is quite as in the type material, but with possibly stronger cusps and crests, although this is less evident in comparison with the Torrejon referred M_2 (USNM No.

25257) which corresponds closer in size to Shotgun Buttes material. Nevertheless, the anterior crest and parastyle are a little better defined than in the Torrejon materials, as is the posterior crest of the talonid and its slightly broader elevation of the hypoconulid portion in M_1 and M_2.

M_3 is not represented in the Torrejon material, but three M_3's in the Shotgun Buttes material are of an appropriate size and exhibit a trigonid so like that in the several M_2's represented that there seems no doubt of their relationship. The talonid portion shows a strongly developed hypoconid with a deep lingual fold on the crista obliqua much as in M_2, and as also noted in *Paromomys maturus*. The entoconid, as in the anterior teeth, is more prominently developed and the hypoconulid portion, strongly bicuspid in at least one of the teeth, is more constricted posterior to the hypoconid than in smaller *Paromomys maturus*. This constriction is emphasized by the relatively greater breadth of the talonid forward across the hypoconid-entoconid portion in the Shotgun Buttes M_3's.

Paramomys, near *P. depressidens* Gidley
(Figs. 5a and b)

Approximately twelve upper teeth and eight isolated lower teeth in addition to a jaw fragment with M_1 and M_2 (AMNH No. 88310, see Fig. 5b) represent a form that appears close to the Crazy Mountain species *Paromomys depressidens* Gidley (1923). The teeth average a little smaller than in that species and in details of structure they appear slightly more progressive in the direction of *Phenacolemur*. Nevertheless, they resemble a little more closely *P. depressidens* than they do contemporary and later materials of *Phenacolemur*. Of the two forms of *Paromomys* known from the Gidley Quarry, *P. depressidens* is distinctly more *Phenacolemur*-like than the genotype, *Paromomys maturus*, particularly in the forward tilt of the trigonid in the lower molars.

It has been possible to select a composite series of upper teeth from P^4 to M^3 that appear to be conspecific (Fig. 5a). These are only slightly smaller than in the type of *P. depressidens*. The relative width of these teeth transversely is decidedly more as in *P. depressidens* than it is, for example, in *Phenacolemur frugivorus* Matthew and Granger (1921). The one P^4 here included has the primary cusp (paracone) and deuterocone (protocone) somewhat less strongly developed than in the type of *P. depressidens*, although a tritocone (metacone) is perhaps a little better defined, but not, however, as in *Phenacolemur*. The outer wall of this tooth is convex as in *P. depressidens*, not bilobed as in *Phenacolemur*, but the gently sloping posterolingual basin is a little better expanded than in the Lebo specimen. The primary cusps of the molars are much as in *P. depressidens* and I see little in the outer wall and cingulum to distinguish them. I note, however, a slightly greater lingual expansion of the postero-internal basin in most of the molars than in the type, giving the lingual margin a slightly bilobed appearance, more distinctly seen in *Paromomys maturus* and certain referred specimens of *P. depressidens*,

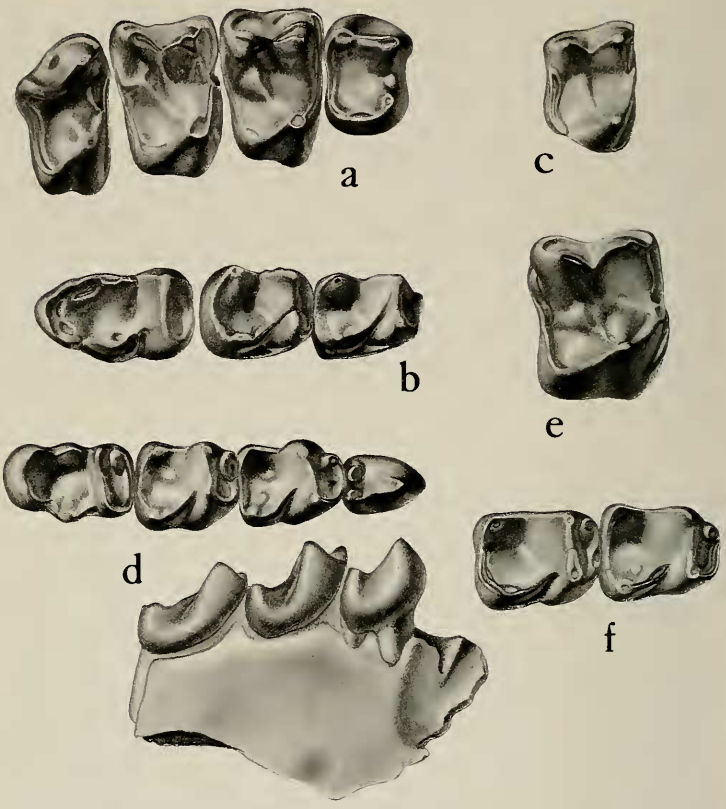


Fig. 5. a and b, *Paromomys*, near *P. depressidens* Gidley. a, Composite right upper cheek-tooth series: P^4, M.C.Z. no. 18764; M^1(?), U.W. no. 3247; M^2, U.W. no. 3248; M^3, U.W. no. 3249; occlusal view. b, Composite right lower cheek-tooth series: M_1 and M_2, A.M.N.H. no. 88310; M_3, M.C.Z. no. 18765. c and d, *Phenacolemur fremontensis*, n. sp. c, Rt. M^2(?), U.W. no. 3250, occlusal view. d, Rt. ramus of mandible with P_4–M_2, A.M.N.H. no. 88309 (type), occlusal and lateral views (M_3 in occlusal view, M.C.Z. no. 18766 reversed, not part of type). e and f, *Phenacolemur*, cf. *frugivorus* Matthew and Granger. e, Rt. upper molar, M.C.Z. no. 18767, occlusal view. f, Composite right anterior lower molars: M_1, M.C.Z. no. 18768; M_2, M.C.Z. no. 18769; occlusal view. All figures ×8.

but this basin is not developed posteriorly as in *P. frugivorus*. The conules of the upper molars are for the most part rather indistinct or non-existent. The protoconule in the Gidley Quarry materials is a little more evident.

The lower teeth regarded as representing a species close to *P. depressidens* include four M_1's, three M_2's and one M_3, in addition to the jaw fragment with two anterior molars. These all show the forward sloping trigonid, or the phenacolemurid-like appearance of the *P. depressidens* lower molars. The crown of the trigonid in some of the teeth, however, tends to be a little more rectangular than in the earlier material, although I note some variation in this respect. In *P. depressidens* the crown of the M_1 trigonid is essentially triangular and in the succeeding molars the anterior margin is in general distinctly convex forward. In the Shotgun material three of the M_1's (as in Fig. 5b) show an antero-external angle giving the trigonid a less triangular appearance. This portion, however, is not so shortened anteroposteriorly as, for example, in *Phenacolemur frugivorus*. Two of the isolated M_2's, as well as the single third molar shown in Figure 4b, exhibit a trigonid crown a little less convex forward than in most of the *P. depressidens* material. The talonid portions of the lower molars are essentially as seen in the Gidley Quarry materials, except that the third lobe or hypoconulid portion of M_3 appears a little less constricted transversely, but not nearly so broadened as in *Phenacolemur*.

Measurements (in mm) of teeth in *Paromomys*, near *P. depressidens*.

P^4 (M.C.Z. No. 18764),	
anteroposterior diameter externally	1.6
transverse diameter	1.9
M^1(?) (U.W. No. 3247),	
anteroposterior diameter externally	1.8
transverse diameter anteriorly	2.6
M^2 (U.W. No. 3248),	
anteroposterior diameter externally	1.8
transverse diameter anteriorly	2.7
M^3 (U.W. No. 3249),	
anteroposterior diameter perpendicular to anterior wall	1.4
greatest transverse diameter	2.5
M_1 (A.M.N.H. No. 88310),	
anteroposterior diameter	2.0
greatest transverse diameter	1.5
M_2 (A.M.N.H. No. 88310),	
anteroposterior diameter	2.2
greatest transverse diameter	1.6
M_3 (M.C.Z. No. 18765),	
anteroposterior diameter	2.7
greatest transverse diameter	1.6

Phenacolemur fremontensis n. sp

(Figs. 5c and d)

Type: Right ramus of mandible with P_4–M_2 (A.M.N.H. No. 88309).
Horizon and locality: Shotgun member (lower level) of Fort Union

formation, near Cottonwood Creek, sec. 30–31, T. 6 N., R. 3 E., northwestern part of Wind River Basin, Wyoming.

Specific characters: Size of P_4 much smaller than in *Phenacolemur frugivorus*. Lower molars a little smaller and relatively much narrower, with talonid basins relatively longer and narrower.

Discussion: Two isolated upper molars (one shown in Fig. 5c) are referred to this species, and in addition to the type lower jaw (Fig. 5d) there are ten isolated lower molars. These teeth are only a little smaller than those described above as *Paromomys*, near *P. depressidens*, but are distinctly more phenacolemurid appearing.

The isolated upper molars, evidently both M^2's, are shorter anteroposteriorly than in the type of *P. frugivorus* and seem to be relatively a little wider transversely. They show the somewhat oblique (anteroexternal to postero-internal) elongation, and with the metacone a little smaller than the paracone, much as in the Tiffanian type. While only a little smaller than the M^2 in the material described as more closely related to *P. depressidens*, they show a decidedly more expanded posterolingual basin, as seen in *P. frugivorus*. The crests from the protocone are low, except that enclosing the posterolingual basin, and directed much as in the Tiffany form, with essentially no development of the conules.

P_4 is recognized only in the type lower jaw and is seen to conform closely to this tooth in the Melville lower jaw of *P. frugivorus* figured by Simpson (1936, Fig. 13; and 1955, Pl. 32, Fig. 1) but is relatively much smaller than in this specimen, or that from the Colorado Tiffany (A.M.N.H. No. 17408). The tooth has a simple, single cusped primary portion with a smoothly convex anterior margin, as seen in profile, and a relatively broad bicuspid talonid portion. The anterior molars are only a little shorter than in *P. frugivorus*, but relatively narrower, particularly M_2. This gives the trigonids and talonid basins a more elongate appear-

Measurements (in mm) of teeth in *Phenacolemur fremontensis*, n. sp.

M^2 (U.W. No. 3250),	
anteroposterior diameter externally	1.6
transverse diameter anteriorly	2.5 (est.)
P_4 (A.M.N.H. No. 88309, type),	
anteroposterior diameter	1.3
transverse diameter	0.9
M_1 (A.M.N.H. No. 88309, type),	
anteroposterior diameter	1.7
greatest transverse diameter	1.2
M_2 (A.M.N.H. No. 88309, type),	
anteroposterior diameter	1.7
greatest transverse diameter	1.3
M_3 (M.C.Z. No. 18766),	
anteroposterior diameter	2.3
greatest transverse diameter	1.2

ance anteroposteriorly. The trigonid crowns are more nearly rectangular than in the Shotgun material referred to *Paromomys*, near *P. depressidens*. In M_2 of *P. fremontensis* the width of the trigonid and talonid portions is about equal, whereas in *P. frugivorus* the talonid portion is noticeably wider than the trigonid column. M_3, except for its smaller size, is strikingly like that in the figured lower jaw of *P. frugivorus* (Simpson, 1935, Fig. 7).

Phenacolemur, cf. *frugivorus* Matthew and Granger
(Figs. 5e and f)

Two upper molars and eight isolated lower molars are too large to be included in the materials designated *Phenacolemur fremontensis*. These are entirely comparable in size to teeth in *Phenacolemur frugivorus* Matthew and Granger (1921). One of the upper teeth, an anterior molar (Fig. 5e) is slightly longer anteroposteriorly than either M^1 or M^3 in *P. frugivorus* and is relatively a little wider. It is not nearly so large or relatively wide, however, as in *Phenacolemur pagei* Jepsen (1930) from the Silver Coulee at Polecat Bench, to judge by Simpson's figures (1955, Pl. 33, Figs. 1 and 2) in his comparison between *P. frugivorus* and *P. pagei*. The lower molars (Fig. 5f) appear entirely comparable in size and relative width to those of *P. frugivorus*, although the M_2's show a little less difference in width between the trigonid and talonid than seen in the Tiffany jaw from Colorado (A.M.N.H. No. 17405). The width of the lower molars is not nearly so great relative to length, as observed in Simpson's illustration of *P. pagei* (1955, Pl. 32, Fig. 2).

Carpolestidae

Elphidotarsius shotgunensis n. sp.
(Figs. 6a and b)

Type: Right ramus of mandible with P_4 and M_1, A.M.N.H. No. 88311.

Horizon and locality: Shotgun member of Fort Union formation near Cottonwood Creek, sec. 30–31, T. 6 N., R. 3 E., northwestern part of Wind River Basin, Wyoming.

Specific characters: Size of M_1 near that of *Elphidotarsius florencae* Gidley (1923), but P_4 relatively a little larger. Primary portion of P_4 shows four cusps as in *E. florencae*, but possibly less well defined. Trigonid of M_1 with paraconid and metaconid more widely separated but both lingually placed with respect to the protoconid.

Discussion: Of particular interest in the type of *Elphidotarsius shotgunensis* (see Fig. 6a) is the portion of the jaw preserved anterior to P_4. Three nearly circular alveoli are seen, evidently for C (with its root), P_2 and P_3, that for P_2 being slightly smaller than the other two. The first of these is not offset lingually as in *Carpodaptes hobackensis* Dorr (1952). More anteriorly there are three grooves, possibly for three incisors with slender roots that are nearly straight or only slightly curved. These would indicate at least one and possibly two more incisors than seen in

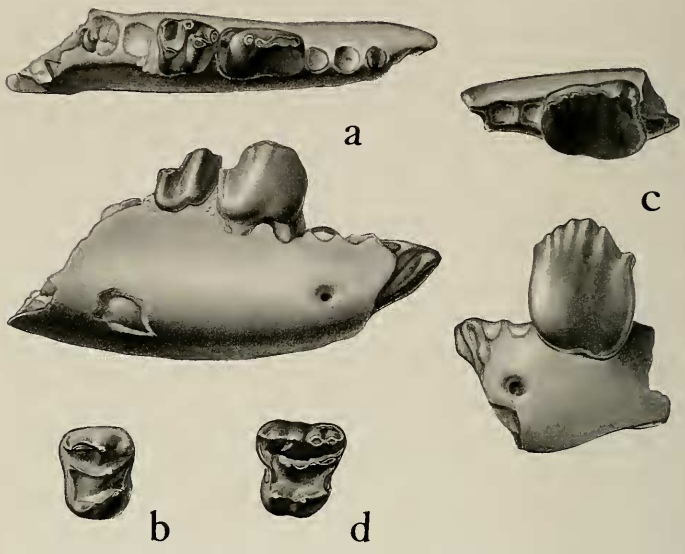


Fig. 6. a and b, *Elphidotarsius shotgunensis*, n. sp. a, Rt. ramus of mandible with P_4 and M_1, A.M.N.H. no. 88311 (type), occlusal and lateral views. b, Rt. upper premolar, M.C.Z. no. 18774, occlusal view. c and d, *Carpodaptes*, sp. c, Lt. ramus of mandible with P_4, M.C.Z. no. 18763, occlusal and lateral views. d, Lt. P^3, M.C.Z. no. 18776, occlusal view. All figures ×6.

C. hobackensis. The lower extremities of the anterior two grooves are close together and appear transversely arranged about beneath the root of the canine. The anterior or inner of the three grooves does not appear as smooth as the second and may not be an alveolus although its configuration is very suggestive. It makes an angle of approximately 45 degrees with the superior margin of the preserved portion of the jaw. The second groove, better formed and less eroded appearing than the first, is most clearly an alveolus. Its size does not appear greatly different than that of the first, but it is less sloping or a little more erect. It is relatively much smaller than the single incisor root in *C. hobackensis*. The posterior and most lateral groove is the smallest and most nearly erect. It is situated immediately anterolateral to the comparatively large alveolus with its preserved root believed to be for the canine. It seems entirely probable that this third groove is an alveolus for a lateral incisor.

P_4 in the type shows a closer correspondence to this tooth in earlier *Elphidotarsius florencae* from Gidley Quarry than to P_4 in the Tiffanian materials of *Carpodaptes* or *Carpolestes*. It appears a little advanced over *E. florencae* in its relatively greater size with respect to the first

molar, but not nearly so large as in later genera. The primary portion shows the same four cuspules as in *E. florencae*, although this portion is a little more blunt and the cuspules more subdued, possibly as a result of wear in *E. shotgunensis*. Their alignment is a little better, although the posterior of the four is offset lingually, but not so noticeably as in *E. florencae*. The small talonid portion is much the same in the two forms.

M_1 has a length close to that in *Carpodaptes aulacodon* Matthew and Granger (1923; see also Simpson, 1935) and *Carpodaptes hazelae* Simpson (1936), as well as *Elphidotarsius florencae*, but is not nearly so broad as in these species of *Carpodaptes*, particularly *C. hazelae*. This tooth is comparatively high-crowned, most noticeably on the labial side, with a deep crease separating the column of the hypoconid from that of the higher protoconid. The cusps of the trigonid form a V-shaped pattern which is a little more obtuse than in *E. florencae* but not so nearly aligned anteroposteriorly as in *Carpodaptes*. The short talonid of M_1 with the crista obliqua extending to the summit of the metaconid shows little of significance distinguishing it from that in *E. florencae*. Its basin is not so broad relatively as in *Carpodaptes*.

In addition to the type specimen of *Elphidotarsius shotgunensis* only an isolated M_1 and a right upper premolar, presumably P^4, in the various collections at hand, are thought to represent this species. The M_1 is relatively a little wider than in the type but much less than indicated by Simpson's measurements (1935, p. 12; and 1936, p. 22) for species of *Carpodaptes*. Also, the trigonid is more like that in *E. shotgunensis*.

The upper premolar (Fig. 6b) is much smaller than seen in *Carpodaptes hazelae* (see Simpson, 1936, Fig. 12; and 1937a, Fig. 3) and while upper teeth of *Elphidotarsius* are not known in the Gidley Quarry collections, this tooth would seem to be appropriate in size for *E. shotgunensis*. It is, moreover, somewhat less progressive in its development compared with *C. hazelae* in that there are only three definable outer cusps, the median of which is the largest and well separated from the less elevated antero-external cusp. The latter appears continuous with the weak outer cingulum. The median crest extends from close to the antero-external cusp to the posterior margin of the tooth with the single conule well forward. Lingually, the talon is relatively broad, the deuterocone (protocone) is prominent, and a worn position posterolingually suggests a definable tetartocone (hypocone).

P_4 in the type of *E. shotgunensis* (A.M.N.H. No. 88311) is 1.9 mm long by about 1.2 mm wide. M_2 is 1.5 mm long by about 1.1 mm wide. The referred M_1 (M.C.Z. No. 18775) is 1.6 by about 1.3 mm and the upper premolar (M.C.Z. No. 18774) is 1.5 by 1.8 mm.

Carpodaptes sp.

(Figs. 6c and d)

Two isolated fourth lower premolars from anthill localities are seen to be much too large and high-crowned to represent *Elphidotarsius shot-*

gunensis. In length they are about intermediate between *Carpodaptes aulacodon* and *Carpodaptes hazelae*, but perhaps a little broader than in either. The primary portion of one tooth (M.C.Z. No. 18777) has five cuspules and the other (M.C.Z. No. 18763) has six, a very small cuspule is added on the anterior slope of the latter. Both show a small single cusped talonid, relatively a little smaller and somewhat higher placed than on *E. shotgunensis* but not raised to closely join the cuspules on the crest of the primary portion as in *Carpolestes*.

One of the foregoing fourth lower premolars (M.C.Z. No. 18763, see Fig. 6c) includes a fragment of jaw which exhibits nearly equal sized alveoli for P_2 and P_3. Immediately anterolateral to the first of these is a rather small alveolus, presumably for the canine, which is much smaller appearing than in *Carpodaptes hobackensis*. This is preceeded anteromedially by a large incisor alveolus, only moderately procumbent, with a slope approximating that of the median or second groove in the *Elphidotarsius shotgunensis* jaw.

An isolated third upper premolar (M.C.Z. No. 18774, see Fig. 6d) also from an anthill locality is included here as it closely resembles the tooth figured by Simpson (1937a, Fig. 3) for *Carpodaptes hazelae*. It has the same anteroposterior length as that given in the table of measurements (*ibid.*, p. 8) but is slightly narrower. There are four cusps in the outer row with a small cuspule on the cingulum at the anterior extremity of this row. A somewhat sinuous median crest is exhibited with a well defined cuspule at the anterior extremity, and lingually the talon has two well developed cusps.

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